National Bureau of Standards

TECHNICAL NEWS BULLETIN

SEPTEMBER 1946 No. 353

Absorption Measurements Define Concrete Wall Thicknesses for Protection Against Broad Beams of X-Rays

Concrete walls 51 inches thick will afford adequate protection against 2,000,000-volt broad-beam X-rays, and walls 36 inches thick against those of 1,000,000 volts, when the subject is 4 ft from the source and the current is 3 milliamperes, according to data reported in the August Journal of Research (RP1735). These are maximum thicknesses representing about the most severe conditions that may be encountered. At greater distances and with smaller currents, walls of less thickness will afford satisfactory protection.

The extensive industrial use of X-rays for inspection purposes necessitated precautions to protect the health of the large number of workers in this field; it is estimated that there was a 2,000-percent increase in personnel engaged in this type of work during the war. Although it has long been known that X-ray work can be carried out with complete safety when proper precautions are taken, it was necessary to establish detailed specifications for safeguards in this particular service. No data directly applicable to industrial conditions was available, as all previous efforts had been directed toward protection from narrow beams, that react in an entirely different manner from the broad beams used in industry. Accordingly, a committee of the American Standards Association, with George Singer of the Bureau's X-ray Section as chairman, and representing industry, labor, hospitals, medical schools, insurance companies, and government agencies, undertook the development of a safety code for the industrial use of X-rays. This code has now been adopted as an American War Standard, Z54.1–1946.

Making use of the best biological information available, the committee adopted a permissible daily dose of 0.1 roentgen per day. In other words sufficient protection must be interposed between the source and a person so that he will receive no more than 0.1 roentgen in 24 hours.

As one phase of the program, absorption measurements were obtained for broad beams of 1- and 2-million-volt X-rays, at the laboratories of the General Electric Company in Schenectady, by Carl B. Braestrup of the Department of Hospitals, New York City, and Harold O. Wyckoff and George Singer of the Bureau staff.

The observations were made in a room equipped with a clear opening between the X-ray source and the ionization chamber used for determining the strength of the radiation. The opening, a doorway, was closed with concrete blocks that were built up in layers to make walls of different thicknesses. Suitable precautions were taken that there were no leaks around and between the blocks, so that the radiation measured was actually radiation which had passed only through the concrete.

The results are presented in curves and tables showing the thickness of concrete (density, 2.35 g/cm^3, or 147 lb/ft^3) required for primary protective barriers, for operation at different currents and at different target distances. A correction should be applied if the concrete is of another density. Although described as preliminary results, they represent the best technical data as yet available, and are considered sufficiently reliable for the present purposes. As higher voltages are becoming available for use in generating X-rays, the work is being extended, with refinements in apparatus and procedure. At the same time the present data will be brought up to date, to reflect these improvements.

Circular on Proving Rings for Calibrating Testing Machines

Testing machines, that is, machines which are used for testing strength and similar properties of engineering and structural materials by the application of forces, require frequent periodic calibration to capacity, if reliable test results are to be obtained, as shown by

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experience at the Bureau and in other laboratories using these machines.

The proving ring, developed by H. L. Whittemore and the late S. N. Petrenko of the Bureau's Engineering Mechanics Section, is a portable device for calibrating testing machines. It can be calibrated and transported conveniently to the testing machine for measuring the forces applied by the machine. The proving ring is essentially an elastic ring of heat-treated alloy steel to which forces may be applied along a diameter. The change in diameter caused by the force is measured by a screw micrometer. Proving rings with capacities from a few hundred pounds to 300,000 pounds, which are being produced commercially, now provide satisfactory means for calibrating testing machines up to about 2,000,000 pounds capacity.

Proving rings must be calibrated under accurately known forces, and dead-weight machines capable of applying forces up to 111,000 pounds have been installed at the Bureau. In this connection, methods of calibrating devices for loads exceeding 111,000 pounds by means of several calibrated 100,000-pound-capacity proving rings were developed. As these are the only machines available for this purpose, a large number of proving rings are submitted for test and many inquiries are received concerning their use.

In order to make the data more readily available, information on proving rings has been published as a Bureau Circular, C454, Proving Rings for Calibrating Testing Machines. The Circular describes the proving ring, its calibration, and use, and gives a specification for proving rings. A discussion of the errors which may arise from unusual conditions of use is also included. The results given indicate that the errors of the proving ring are small compared to the generally recognized tolerance of ± 1 percent for testing machines.

Theory for Axial Rigidity of Structural Members Having Ovaloid or Square Perforations

In many modern structures, especially bridges, the columns have a built-up box-type cross section in which cover plates replace the conventional lattice bars and battens. The cover plates are perforated at intervals to allow access to the interior of the columns for inspection and painting.

The axial rigidity of a column is reduced by the presence of these perforations, that is, the column will shorten more for a given load than it would if the perforations were absent. A knowledge of the rigidity of the various members of a structure may be required for accurate analysis and design.

Formulas from which axial rigidity can be computed in the cases of circular, elliptical, and some types of ovaloid holes have been developed and published by the Bureau. This has now been extended to include cases in which the perforations are of various other shapes, including additional types of ovaloid as well as square perforations. Results of this work are reported by Martin Greenspan in the September Journal of Research (RP1737).

TECHNICAL NEWS BULLETIN

U. S. Department of Commerce
Henry A. Wallace, *Secretary*

National Bureau of Standards
E. U. Condon, *Director*

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Contents

Condensation in Specimen Walls Studied in Laboratory

The desirability of vapor barriers as a safeguard against condensation in building walls has been demonstrated through laboratory tests conducted in the Bureau's Heat Transfer Section. Ventilating the interior of the wall with air from the cold side was also found to be effective in reducing condensation. In these tests, specimen walls were exposed to cold air on one side and to warm, humidified air on the other side, under conditions a little more severe than those ordinarily expected anywhere in the continental United States.

Moisture resulting from condensation of water vapor in the walls, or in other parts of a building, may cause serious damage either to insulation or to house timbers. It may impair the efficiency of insulation and shorten its life; or it may cause rot in the wood of the timbers.

Eight specimen walls, each consisting of a different arrangement of insulation and vapor seal mounted in a specially constructed panel, were tested. The insulations included shredded redwood bark, both with and without a vapor barrier; wood-fiber blanket; rock wool without a covering (both with and without ventilation), with an untreated kraft paper covering, and with an asphalt-saturated kraft vapor barrier; and aluminum foil, itself a vapor barrier as well as an insulator.

The panel, approximately 3 by 7 ft, was built of conventional materials, simulating ordinary frame-wall construction; that is, frame of 2- by 4-in. Douglas fir, inside face of plaster on metal lath, and outside face of shiplap siding on sheathing with sheathing paper between. The panel was fastened together with wood screws to facilitate assembling and dismounting. During tests the insulations were placed in the stud spaces.

The specimen walls were mounted between two watertight boxes, one maintained at 70° F and 30-percent relative humidity, and the other at −5° F, so constructed that the only water-vapor migration would be through the walls.

Results of these tests are reported by Richard S. Dill and Herman V. Cottony in Building Materials and Structures Report BMS106, "Laboratory Observations of Condensation in Wall Specimens." In this report they show that condensation phenomena may be observed in the laboratory, and that in many cases the occurrence of condensation can be satisfactorily predicted by computations based on the water-vapor pressure and the laws of diffusion, provided the process is not complicated by air leaks in the vapor barrier. Data reflecting the migration of water vapor through the walls are presented in tabular form. Diagrams are included for each test, showing the panel arrangement and giving the vapor pressure and temperature gradients observed during the test.

Copies of BMS106 may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., at 10 cents each.

A complete list of Building Materials and Structures Reports, arranged both in numerical order and by subjects (Letter Circular LC800), is available without charge from the National Bureau of Standards, Washington 25, D. C.

Fire-Resistance and Sound-Insulation Ratings Presented for Walls, Partitions and Floors

Fire-resistance and sound-insulation ratings of more than 500 floor, partition, and wall constructions, representing masonry, wood, and metal types, have been tabulated in a mimeographed pamphlet, designated as Technical Report on Building Materials TRBM44.

In the construction of buildings, particularly those of residential type, partition and floor constructions should provide safety from the spread of fire and should reduce transmitted sounds and objectionable noises to satisfactory levels. The ability of a construction to prevent the spread of fire is expressed in terms of fire resistance, that is, the time for which the construction may be exposed to a fire of standard intensity without collapse, passage of flame, or transmission of heat sufficient to cause ignition of combustible material. The sound insulation is measured by the decrease in intensity of the sound as it travels through the wall. The fire resistance required by the National Housing Agency for floors, walls, and partitions separating family units in multiple dwellings is ¾ hr, and the minimum sound transmission loss 40 to 45 decibels.

Fire-resistance ratings are presented in 22 tables and sound-insulation ratings in 13 tables, under the general headings masonry walls; wood-stud, steel-stud, and solid plaster partitions; and wood-or-steel-joist, concrete, and steel-plate floors. The fire-resistance ratings are based in general on tests made in the Bureau's Fire Resistance Section, according to the "American Standard Specifications for Fire Tests of Building Construction and Materials" (ASA No. A2.1–1942); some however were made by Underwriters Laboratories and at the Ohio State University. The sound-insulation tests were made in the Bureau's Sound Section by methods described in Building Materials and Structures Report BMS17, and supplement, "Sound Insulation of Wall and Floor Construction."

Resinous Sealants for Porous Metal Castings

The production of pressure tight castings is a foundry problem that frequently presents considerable difficulties. During the war the production schedules for certain fittings, housings, and other castings that had to be pressure tight, were in many instances hampered because of porosity rejections. It was suggested that many of these rejected castings might be salvaged by impregnation with suitable resins. Although considerable work had been done in this field, very little useful information has been published.

Because of the widespread interest in this subject an investigation of the suitability of fourteen synthetic resins for repairing porous castings was carried out at the Bureau. This work is described in the September Journal of Research (RP1740) by Vernon C. F. Holm, of the Bureau's Division of Metallurgy.

Porous bushings of aluminum, a copper-silicon alloy, and a red brass were cast especially for this purpose in the Experimental Foundry, some to exact size, 2- by 2-in. cylinders with ⅛-in. walls, others oversize and machined to this size. Specimens were impregnated with the resins by the vacuum-pressure method, and the sealing efficiencies of the resins determined by hydrostatic pressure tests.

The two most promising sealants, a phenolic resin in alcohol solution and a styrene-polyester resin, were se-

lected for further tests. Specimens sealed with these resins were exposed to hot motor oil, high octane gasoline, boiling water, elevated temperatures, and thermal shock. The influence of moderately high pressure on specimens treated with these two sealants also was determined. The styrene-polyester resin was more satisfactory for sealing castings that were exposed to petroleum products or subjected to thermal shock conditions. The phenolic resin was somewhat superior in exposure to elevated temperatures and specimens sealed with this resin withstood higher pressures without leaking. Both resins were reasonably stable in exposure to boiling water.

Although impregnation with sealants may be a useful method for rendering certain types of porous castings pressure tight for limited service conditions, the results of this investigation suggest that, in general, the foundryman should attempt to avoid porosity in castings rather than to cure it.

Equation Relates Viscosity and the Extraordinary Heat Effects in Glass

As glass cools from the liquid to the vitreous solid state, it passes through a range, known as the annealing range, in which the viscosity increases very rapidly. At the same time strains are set up in the glass. As the glass cools, it must be annealed, or held at temperatures within this range, not high enough to soften the glass, but sufficiently high to relieve these strains.

Studies of glass within its annealing range have shown certain unusual properties, such as the endothermic and exothermic heat effects, that are referred to as extraordinary heat effects. In the August Journal of Research (RP1730), an equation is presented by Arthur Q. Tool, that relates these various extraordinary heat effects to the inelastic deformability and to the degree of superheating or undercooling.

By using this equation in connection with the thermal expansion curves of a glass within its annealing range, certain constants that are related to the coefficient of viscosity and its changes with temperature and the degree of superheating or undercooling have been determined with reasonable results. Such results make it possible to estimate the inelastic deformability of a glass in its various conditions at all annealing temperatures and are, therefore, valuable in connection with problems that are encountered in the process of annealing glass.

The apparent success achieved in applying the proposed equation to experimental data suggests that the concepts underlying this equation are fundamental and must be considered in any theory concerning the constitution of glass or that of any other extremely viscous liquid.

The Optical Glass Industry, Past and Present

Although the history of optical glass dates from ancient times (magnifying lenses of that period have been unearthed), it was not until 1790 that its manufacture in the modern sense began. The invention of a means of stirring the molten glass by Pierre-Louis Guinand was the first major improvement in the industry. In 1880, the work of O. Schott at Jena, Germany, gave final impetus to the industry by making available many oxides not previously used.

The production of optical glass in the United States was started about 1893 by Macbeth and Co., Pittsburgh, Pa., with the assistance of Edmond Feil, a great-grandson of Pierre-Louis Guinand. This work has been continued to the present day, by the Bausch & Lomb Optical Co. (since 1912) and by the National Bureau of Standards (since 1914).

The various procedures used in the production of optical glass, namely, pot making, melting, breaking open the pots and trimming, inspection, molding, and annealing are described briefly in a paper by Francis W. Glaze, prepared for publication in Sky and Telescope. The paper continues with a description of the methods used in producing two large telescopic disks in the United States: (1) the 70-inch disk for Ohio Wesleyan University by the National Bureau of Standards, and (2) the 200-inch disk for the California Institute of Technology by the Corning Glass Works. It is concluded that the optical glass industry in the United States is capable of fulfilling the requirements of optical designers and astronomers, no matter how fantastic these requirements may seem.

Wartime Activities on Plating at the National Bureau of Standards

Emphasizing the important service that the electroplating industry rendered in the war, William Blum, Chief of the Electroplating Section, has outlined the Bureau's contributions in this field toward meeting specific new demands and making possible substitutions for strategic materials.

Among the more significant activities were those involving the protection of gun barrels from erosion and of steel cartridge cases against corrosion. As the result of a cooperative project between the National Bureau of Standards and the Geophysical Laboratory, commercial production of chromium plated caliber-0.50 barrels was undertaken with War Department approval. Chromium plating was applied to the unlined portions of those barrels equipped with stellite breech

liners, and also to barrels made from nitrided steel. These studies produced valuable information on the properties of electrodeposited coatings of the more common elements, such as chromium, zinc, and manganese, as well as of some alloys; for example, alloys of tungsten or molybdenum with iron, nickel, or cobalt.

Other problems arising from the scarcity of certain metals, notably copper, zinc, aluminum, chromium, nickel, and tin, received attention. For instance, a process was developed for producing iron electrotypes as a substitute for the common electrotypes of copper. The Bureau also cooperated with the War Production Board and other agencies in efforts to meet essential civilian needs with materials that were available.

Steel, when substituted for the non-ferrous metals, usually required protection against corrosion, which in many cases could be furnished satisfactorily by electroplating. Some of the materials protected in this way were zinc-coated steel one-cent coins, chromium-plated mess trays, and plated steel tableware. Experience with this latter item, particularly through actual tests in camp service, demonstrated the importance of these tests in evaluating coatings and in determining the type of protection required. The tests also showed that plated coatings can be designed to meet very severe service conditions.

Special forms of the magnetic thickness gage ("Magne-gage") were designed and calibrated for measuring the thickness of very heavy coatings of nickel on steel, and the thickness of coatings on the inside of tubes such as gun barrels. As measurements with Magne-gages are nondestructive, these instruments were used extensively in testing coatings on many military supplies; over 2,000 of these gages have been calibrated at the Bureau.

In this paper, which will be published in the Proceedings of the American Electroplaters Society, ways are suggested in which the knowledge gained through military applications may be applied to industrial processes. It is also pointed out that many of the investigations are being continued, and details will be published when the work is completed.

Increased Efficiency from Molecular Still of Simple Design

A molecular still of simple and easily constructed design, developed by John Keenan Taylor of the Bureau's Physical Chemistry Section, operates with increased efficiency through the spreading of a very thin, uniform layer of liquid over the entire surface of the evaporator.

Molecular distillation, a high-vacuum process dependent on molecular weights rather than vapor pressures, is particularly useful for materials of high molecular weight. Extensively used in industry, it is of increasing importance in the separation and purification of vitamins, dyes, oils, waxes, and many other kinds of material.

As the process takes place only from an extremely thin layer of the distilland, that is, the material being distilled, it is of utmost importance that this layer at all times be representative of the bulk of the liquid. Adequate renewal of the surface is necessary for efficient operation. Most of the devices suggested to increase the efficiency of molecular stills appear to be either of doubtful value, or else require cumbersome and expensive mechanical equipment for their utilization.

This still, which is described in the September Journal of Research (RP1739), is of the cyclic falling-film type, so constructed that distillation takes place from a heated column, or evaporator, the temperature of which can be accurately controlled. A tube of internal diameter slightly larger than the outside diameter of the evaporator is centered over its top portion, and extended down over the evaporator for a short distance. When liquid is introduced onto the evaporator through the annular orifice so formed, it produces a thin film that starts uniformly around the entire surface of the column and that persists as it falls. Constructed of glass, except for the pump, the still may be used for amounts of liquid ranging from a minimum of 10 ml up to 1 liter or more.

The paper also describes the auxiliary equipment, which includes reservoirs, circulating pump, and a system for collecting fractions.

Effect of Reaction Between Mercury and Oxygen in Aqueous Solutions Upon Polarographic Waves of Certain Metals at Small Concentrations

The polarographic method of analysis is useful for determining small amounts of metals in ores and alloys, plant ashes, biological materials, mineral waters, samples collected in industrial hygiene studies, and other materials. The presence of an unsuspected systematic error in such determinations might lead to expensive mistakes in the value of an ore or the composition of an alloy, or might cause unfortunate consequences through the approval of unsafe respiratory equipment. For example, if a polarographic analysis for lead in fumes were to give a negative result when lead was actually present, serious harm to the health of workers could result.

In the September Journal of Research (RP1736), Edgar Reynolds Smith, John Keenan Taylor, and Roberta Evelyn Smith show that the polarographic waves of certain metals, notably of lead, zinc, copper, cobalt, and nickel in dilute neutral solutions, diminish progressively with time in the presence of mercury and air. This behavior is traced to a reaction between mercury, water, oxygen, and the ions of the metallic salt, which, in some instances, precipitates the metal from solution in the form of its hydroxyde. Recognition of this reaction and precautions to exclude it are essential for accurate polarographic determinations of small amounts of heavy metals.

Thermodynamic Properties of Hydrocarbons

Thermodynamic properties of the six hydrocarbons, ethylene, propylene, 1-butene, *cis*-2-butene, *trans*-2-butene, and isobutene, are reported in the September Journal of Research (RP1738) by John E. Kilpatrick and Kenneth S. Pitzer, of the American Petroleum Institute Research Project 44, and the Bureau's Section on Thermochemistry and Hydrocarbons. Values are presented for the following properties of these hydrocarbons, in the ideal gaseous state, to 1,500° K: Heat-content function $(H°-H°_0)/T$; free-energy function, $(F°-H°_0)/T$; entropy, $S°$; heat content (or enthalpy), $H°-H°_0$; heat capacity, $C_p°$.

New Circular Describes Flameproofing of Textiles

Treatments that reduce the flammability of textiles—sought since ancient times and patented as early as 1735 in England—and that are also reasonably resistant to the effects of water are being applied on a commercial scale to heavy fabrics such as awnings and tentage, according to Circular C455, Flameproofing of Textiles, just released by the Bureau. Treatments, however, that combine both these qualities, along with a suitable finish, are not at present available for fine fabrics, although developments along this line have been reported. Satisfactory treatments that need to be renewed after each laundering have been known for over a hundred years.

A new method that is useful for determining the relative flammability of untreated textiles is also given in the Circular.

Several major disasters resulting from rapid combustion of untreated textile materials—especially the Hartford circus fire and the Boston night club fire—have recently focused public attention on this subject. A number of deaths and severe burns have resulted from use in garments of textiles with rapid rates of burning, and a large military requirement has existed for flameproofed tentage, camouflage, and clothing fabrics. These demands have been met by improvements that render the treatments more effective and more resistive to wear, weather, and other conditions of use.

The Circular, prepared by Marjorie W. Sandholzer, includes a review of the principles of flameproofing, a brief history of researches, and formulas for various processes. An outline of testing methods and requirements for the treated material are also given.

For the treated or intrinsically slow-burning materials a flame test with the fabric in vertical position is outlined. As vertical flame tests are not suitable for comparing the rates of burning of untreated fabrics, a method for determining the rate of burning in horizontal position is also described. Wool, weighted silk, and nylon show little flame spread in this test. Cotton and rayon textiles in the usual weaves will burn at rates from 3 to 25 in. per min, and thin nets and pyroxylin-coated fabrics at greater rates.

A few types of fine-napped rayon and cotton goods will burn at rates in the range 100 to 400 in. per min. Garments made of textiles with such rapid rates of burning represent a serious potential hazard, as evidenced by deaths and burns resulting from their use. However, many textiles with nap of shorter or coarser fibers present no unusual hazard in this respect. The method outlined in the circular is designed to differentiate between these types.

Commercial Standard for Woven Wire Netting

Minimum recommended specifications for woven wire netting are set forth in Commercial Standard CS133–46, which is now available in printed form. This standard covers galvanized wire netting suitable for poultry runs and pens, domestic and furbearing animal pens, crab traps, and stucco reinforcing. Developed voluntarily in cooperation with the Bureau's Division of Trade Standards, it results from the industry's desire for minimum standards for the commodity. It became effective for new production from June 1, 1946.

Grades and sizes which may be considered as standard stock items are included in the standard. The widths and lengths are those believed adequate to serve best the needs of the consumer.

The standard sets forth minimum requirements for mesh sizes and types, wire diameters, and tolerances. All types are supplied in galvanized-after-woven finish, while poultry netting is also supplied in galvanized-before-woven finish. Provision is made for the manufacturer to label his product and to guarantee that the netting complies with the standard.

Manufacturer, distributor, and user organizations are represented on the standing committee, whose chief function is to keep the standard abreast of progress in the industry.

Printed copies of CS133–46, Woven Wire Netting, may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., at 5 cents each.

International Committee on Weights and Measures Elects E. C. Crittenden Member

The election of Dr. Eugene C. Crittenden, Associate Director of the National Bureau of Standards, to membership in the International Committee on Weights and Measures was announced on August 16, by Dr. E. U. Condon, Director of the Bureau.

"Dr. Crittenden's election is not only a distinct personal honor," said Dr. Condon, "but is recognition of the leading role played by the United States through

the National Bureau of Standards in the field of measurements. Standardization and uniformity of measurements are indispensable in science, while in commerce—particularly in export trade—confusion, delay, and errors can be avoided only by international cooperation."

The International Committee, consisting of 16 scientists chosen from the 32 member nations, is engaged in developing scientific standards of measurement and in securing their uniformity throughout the world. The meetings of the Committee, interrupted during the war, are now to be resumed, and the first postwar session will be held at Sevres, France, beginning on October 22, 1946.

The leadership of the United States in the fields of illumination and electrical measurements stems considerably from the activities of the National Bureau of Standards. In this work, Dr. Crittenden has played a prominent part. He is an authority on the measurement of light and has contributed extensively to the field of electrical measurements. For his contributions to the development and establishment of acceptable standards and units for the measurement of light, Dr. Crittenden was recently awarded the Illuminating Engineering Society Medal, highest honor in the field of lighting. He is a Director of the American Standards Association, and Chairman of its Standards Council. A member of many other scientific and technical organizations, he has held office in a number of these, both national and international.

New and Revised Publications Issued During August 1946

Journal of Research [1]

Journal of Research of the National Bureau of Standards, volume 36, number 6, June 1946 (RP1718 to RP1722, inclusive). Price 30 cents. Annual subscription, 12 issues, $3.50.

Journal of Research of the National Bureau of Standards, volume 37, number 1, July 1946 (RP1723 to RP1729, inclusive). Price 30 cents. Annual subscription, 12 issues, $3.50.

Commercial Standards [1]

CS5–46. Pipe nipples; brass, copper, steel, and wrought iron (second edition). Price 5 cents.

CS15–46. Men's pajama sizes—woven fabrics (third edition). Price 5 cents.

CS104–46. Warm-air furnaces equipped with vaporizing pot-type oil burners (second edition). Price 10 cents.

CS131–46. Industrial mineral wool products, all types—testing and reporting. Price 10 cents.

CS133–46. Woven-wire netting. Price 5 cents.

CS135–46. Men's shirt sizes (exclusive of work shirts). Price 5 cents.

Simplified Practice Recommendations [1]

R89–46. Coated abrasive products (supersedes R89–40). Price 10 cents.

Research Papers [1]

RP1704. Analysis of a standard sample of the carburetted water-gas type by laboratories cooperating with the American Society for Testing Materials. Price 15 cents.

RP1705. Spectrographic determination of boron in steel. Price 5 cents.

RP1706. Hygroscopicity of optical glasses as an indicator of serviceability. Price 5 cents.

RP1707. Solubility of cadmium sulfate in H_2O-D_2O mixtures. Price 5 cents.

RP1708. A glossmeter for smoothness comparisons of machine-finished surfaces. Price 5 cents.

RP1709. Absorption and scattering by sound-absorbent cylinders. Price 10 cents.

RP1710. Dynamic tensile tests of parachute webbing. Price 5 cents.

RP1711. Note on the density and heat of combustion of benzoic acid. Price 5 cents.

RP1712. An analysis of the effects of fuel distribution on engine performance. Price 5 cents.

RP1713. Effects of mildew on vegetable-tanned strap leather. Price 5 cents.

RP1714. Heats of combustion and formation at 25° C. of the alkylbenzenes through $C_{10}H_{14}$, and of the higher normal monoalkylbenzenes. Price 5 cents.

RP1715. Heats of combustion of four cyclopentane and five cyclohexane hydrocarbons. Price 5 cents.

RP1716. Size grading of diamond powders. Price 5 cents.

RP1717. Precision of telescope pointing for outdoor targets. Price 5 cents.

RP1718. Crystallization of unvulcanized rubber at different temperatures. Price 10 cents.

RP1719. Hygroscopicity and electrode function (pH response) of glasses as a measure of serviceability. Price 5 cents.

RP1720. Fineness test of molding sand. Price 10 cents.

RP1721. Effect of sodium chloride on the apparent ionization constant of boric acid and the pH values of borate solutions. Price 5 cents.

RP1722. Heats, equilibrium constants, and free energies of formation of the monoolefin hydrocarbons. Price 10 cents.

Basic Radio Propagation Predictions [1]

CRPL–D24. Basic radio propagation predictions for November 1946 three months in advance. Issued August 1946. Price 15 cents. Annual subscription $1.50.

Technical News Bulletin [1]

Technical News Bulletin 352, August 1946. Price 5 cents. Annual subscription, 50 cents.

Mimeographed Material

Weights and Measures News Letter No. 43, issued by the National Bureau of Standards in cooperation with the National Conference of Weights and Measures (July–August 1946). (National Bureau of Standards, Washington 25, D. C.). Available without charge from the Bureau.

Letter Circulars

LC831. (Supersedes LC422) The painting of exterior metal surfaces.

LC832. Bibliography of unclassified books and reports on gas turbines, jet propulsion, and rocket power plants.

LC833. (Supersedes LC823) List of Commercial Standards revised to July 1, 1946.

LC834. Lists of measures offices of the States and District of Columbia.

[1] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Subscription to Technical News Bulletin, 50 cents a year; Journal of Research, $3.50 a year (to addresses in the United States and its possessions and to countries extending the franking privilege); other countries, 70 cents and $4.50, respectively.

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